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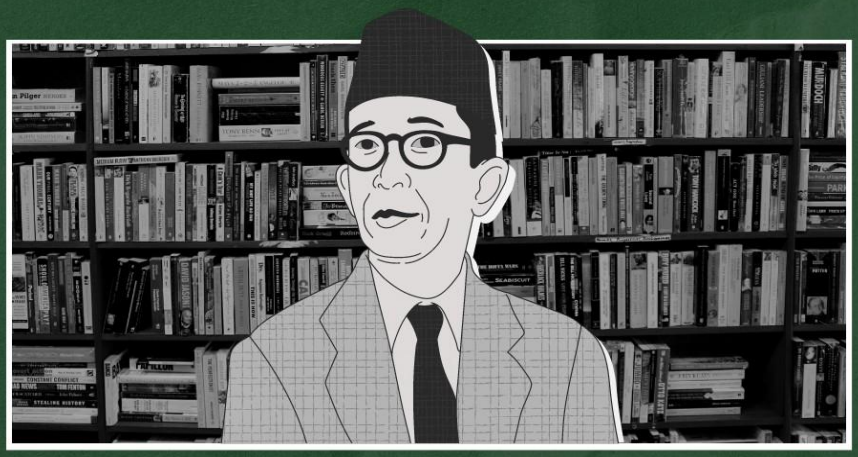

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The Effect of a Therapeutic Program for Genu Varum (Inward Bowing of the Legs) among Primary School Pupils Aged (6–7) Years

Amir Abbas Jabr, ameeralzirfy@gmail.com (*)
Directorate of Education of Najaf Al-Ashraf Governorate, Iraq

(*) Corresponding author

Abstract

General Background: Musculoskeletal deformities in early childhood may limit physical performance and participation in school activities. **Specific Background:** Genu varum (bow legs) in primary school pupils often causes discomfort, restricted movement, and reduced engagement in physical education. **Knowledge Gap:** Limited school-based rehabilitative programs have been systematically implemented and evaluated for young children with this condition. **Aim:** This study aimed to determine the outcomes of a structured eight-week rehabilitative exercise program with assistive tools for primary school pupils aged 6–7 years diagnosed with genu varum. **Results:** Findings indicated statistically significant reductions in knee and heel distance measurements, accompanied by improvements in speed and agility test scores across pre-, intermediate, and post-tests. **Novelty:** The study introduces a structured, school-context rehabilitation model integrating assistive tools with progressive corrective exercises tailored to young pupils. **Implications:** The program may serve as a practical framework for early detection and corrective intervention within primary school and community health settings.

Highlights:

- Structured 8-week corrective exercise program for ages 6–7.
- Significant reduction in knee and heel distance measurements.
- Measurable improvements in speed and agility performance.

Keywords:

Genu Varum, Rehabilitative Exercises, Primary School Pupils, Physical Fitness, Corrective Program

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Introduction

The concept of injury rehabilitation aims to treat and correct the functional capacities possessed by individuals with physical or psychological disabilities or injuries, to develop them, and to make optimal use of their abilities. The concept of rehabilitation also involves preparing a plan or approach that helps recovery from pain either completely or partially, depending on the individual's condition, in order to achieve optimal benefit from the required performance of the injured or disabled person

through performing and practicing specific exercises designed to target the injured or affected body part, as well as reducing the minimum level of pain resulting from injury or disability. Therefore, the process of rehabilitation aims to restore the functions of the damaged or injured organs and improve the quality of life of the individual.[1]

Rehabilitation includes several sequential steps or stages depending on the type of injury, including diagnosing and evaluating the condition or injury by a specialist (physician or physical therapy specialist) to assess the extent and type of injury, as well as pain management (such as the use of medical drugs and alternative treatments, including the use of heat and cold therapy methods such as hot and cold compresses) applied to the site of injury. In addition, a therapeutic training program is used for the condition through special exercises appropriate to the type of injury, such as endurance, flexibility, and strength exercises. Psychological rehabilitation of the injured individual following injury should not be overlooked, as it plays an effective role in dealing with cases of depression and tension that may result after injury, as well as educating the injured person about future injuries by following advice and guidance provided to the athlete to avoid injuries in the long term. Among the challenges facing specialists in this field are limited community awareness and reduced support and funding, which makes it important to develop awareness programs to disseminate the concept of rehabilitation within society.[2]

The importance of injury rehabilitation is evident through belief in this field, as successful and effective rehabilitation can improve the quality and standard of life of the injured person, enhance the ability to integrate into society and work, promote participation with others, and create an appropriate and supportive environment to achieve success in rehabilitation and return individuals to their normal lives and reintegrate them into their surrounding community.

Research Problem

Through the researcher's experience as a former athlete and a physical education teacher at Al-Adeeb Kazem Shukr Primary School, he observed during physical education classes that some pupils refrained from participating in the lesson, did not engage with other pupils during the class, sat outside, and showed no desire to practice sports activities and training during the lesson. This prompted the researcher to investigate the reasons and motives that prevent pupils from participating in physical education classes at school. Upon inquiry, the concerned pupils stated that their lack of participation was due to their inability to perform most exercises and sports movements, especially those involving the lower part of the body (from the lower back down to the feet). After a visual assessment of the pupils' posture, the researcher noticed the presence of a gap between the legs extending from the knees downward to the feet.

This condition may be congenital or result from muscle weakness, vitamin deficiency, or hormonal deficiencies that contribute to the emergence of this problem among pupils. The degree of bowing varies in measurement from one pupil to another depending on individual condition and congenital structure. Consequently, this gap leads to pain and difficulty in performing correct movements during sports activities and physical exercises.

Objective of the Study

● The objective of the study is to identify the effect of a therapeutic program for inward bowing of the legs among primary school pupils aged (6–7) years using rehabilitative exercises and assisting tools on certain variables.

Research Hypothesis

● There is an effect of the therapeutic program for inward bowing of the legs among primary school pupils aged (6–7) years.

Research Fields

- **Human Field:** Pupils of Al-Adeeb Kazem Shukr Primary School, first and second grades.
- **SpatialField:**Al-Adeeb Kazem Shukr Primary School.
- **TemporalField:**From (14/11/2024) to (1/3/2025).

Methods and Procedures

1. Research Methodology

The researcher employed the experimental method (a one-group experimental design) suitable for the nature of the problem and for verifying the research hypothesis of the current study.

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2. Research Population and Sample

The population represents the main of the researcher's work and is considered one of the fundamental pillars upon which scientific research is based. Accordingly, the population of the study was defined as male pupils enrolled in a boys' primary school who were affected and medically diagnosed by the specialist physician Dr. Hamdallah Al-Busaissi in the Governorate of Najaf Al-Ashraf for the academic year (2024–2025). The total number of pupils in the study population was (30), with ages ranging between (6–7) years.

Subsequently, the study sample was selected from the total population. The sample consisted of (3) pupils whose conditions and symptoms were consistent with the subject of the research. These pupils were intentionally selected as the research sample, as they were diagnosed with genu varum (bowlegs). Parental consent was obtained prior to inclusion in the study.[3]

After that, a medical examination was conducted through visual assessment of the pupils' external posture in both standing and walking positions by the specialist physician Dr. Hamdallah Hadi Al-Busaissi, who specializes in joint diseases, fractures, and physical therapy, to identify the affected cases. The total number of pupils who underwent the medical examination was (30) pupils aged (6–7) years. From this group,

(3) pupils were identified as having genu varum, with no accompanying bone problems or deformities in the knees, joints, or cartilage.

Following this, parental approval was obtained to apply the rehabilitation program to the pupils. The sample consisted of a single experimental group

representing the study sample, comprising (3) pupils. Accordingly, the percentage of the study sample amounted to (10%) of the total population, which is considered an appropriate proportion for representing the study population. This is illustrated in Table (1) and shown in Figures (1–2–3).

Table(1). Research sample distribution

Study Population	Number of Pupils with Genu Varum	Pilot Study Sample	Main Study Sample	Percentage
30	3	3	3	10%

3. Means, Tools, and Devices Used in the Research:

For the purpose of collecting information and data, and obtaining accurate scientific facts and findings, the researcher relied on scientific tools, devices, and means that assist in collecting information and data with high precision. These tools were used to gather result-related data from the sample participants employed by the researcher at each stage of the study, in order to achieve the research objectives through the following tools, instruments, and devices:[4]

1. Research Instruments

1. A **questionnaireforsurveyingtheopinionsofexpertsandspecialists**to identify the physical and motor variables related to the study.
2. **Aquestionnaireforsurveyingtheopinionsofexpertsandspecialists**to determine the physical and motor tests related to the study.
3. **Observation.**
4. **Testing and measurement.**
5. **Sources and references.**

2. Devices and Tools Used in the Rehabilitative Program:

1. Medical balls (2).
2. Child-appropriate floor surface.
3. Medical scale.
4. Markers / cones (6).
5. Stopwatch.
6. Computer device.
7. Metal measuring tape (1).
8. Camera (1).

4. Field Research Procedures

3. Physical and Motor Variables

The researcher prepared a questionnaire to obtain data and information related to the most important physical variables and the tests on which the study was based. The questionnaire was then presented to a number of specialists and experts with relevant experience. Variables that obtained an agreement percentage of (80%) or higher from the experts' opinions were adopted.

Subsequently, the researcher calculated the relative importance of each of the main variables identified by the experts and specialists in order to reduce the number of components to a relatively smaller number that could be practically tested.

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5. Tests and Measurements.

- **Physical and Motor Tests**

First: 30 m Sprint Test:[5]

- **Purpose of the test:** Measuring transitional speed.
- **Equipment:** A distance of (30 m), stopwatch, whistle.
- **Performance description:** The pupil stands behind the starting line. Upon hearing the signal, the pupil runs toward the opposite line and crosses it with both feet.
- **Recording:** Time is recorded from the starting line to the finish line to the nearest fraction of a second.

Second: Zigzag Running Test:[6]

- **Purpose of the test:** Measuring agility.
- **Equipment:** A rectangular area drawn on the ground measuring (4 m) in length and (3 m) in width, five cone-shaped markers, and a stopwatch. Four markers are placed at the corners of the rectangle, and the fifth marker is fixed at the center.
- **Performance:** The pupil stands beside one of the four corner markers of the rectangle. After the start signal, the examinee runs in a zigzag pattern forming the shape of the English number (8) until completing the circuit and returning to the starting point, as illustrated in Figure (4).

Instructions:

- The pupil starts running from a stationary standing position.
- The specified running path must be followed, and the markers must not be touched.
- **Scoring:** The time taken by the examinee to complete the distance from the start to the finish is recorded.

Measurement of Genu Varum (Bow Legs)

To diagnosing genu varum among pupils aged (6–7) years, the researcher reviewed relevant scientific sources and references. An initial diagnosis of genu varum was conducted prior to referring the pupils to a specialist physician. The assessment involved measuring the distance between the knees and the distance between the heels while the pupil stood in a neutral, upright position.[7]

If the measured distance between the knees was (5 cm) or less, the pupil was considered to have genu varum. Likewise, if the measured distance between the heels was (15 cm) or more, the pupil was also considered to be affected by the condition.

6. Pretests

The pre-test was conducted on the participants of the study sample prior to the implementation of the rehabilitation program. This was done in order to determine the degree of genu varum (bow legs) and to measure the physical and motor abilities of the study sample before commencing the application of the rehabilitation program. The pre-test was conducted on **22/12/2024**.

7. Rehabilitative Program

The rehabilitative program was applied from 22/1/2025 to 22/3/2025.

8. Preparation of the Rehabilitative Program

The researcher reviewed relevant scientific sources, references, and previous studies related to the subject of the present research, and conducted personal interviews with a number of experts and specialists in sports medicine and rehabilitation. The purpose of this was to design appropriate rehabilitation exercises that correspond to the type of injury, as follows:[8]

1. A rehabilitation program designed to treat genu varum (bow legs).
2. Duration of application: (8) weeks.
3. A total of (24) rehabilitation sessions.
4. Three rehabilitation sessions per week.
5. The rehabilitation program was designed in accordance with the principles and standards of sports training science, medical rehabilitation, and approved physical therapy practices.
6. The use of supportive and assistive means in implementing the exercises included in the program.
7. Consideration of individual differences among the pupils within the rehabilitation program.
8. Providing rest intervals according to the child's tolerance capacity during exercise performance.

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9. Main Experiment

After completing the pilot study, the main experiment was conducted. This phase was implemented through the research procedures, beginning with the pre-tests, followed by the application of the rehabilitation exercises and the assistive means designed by the researcher based on scientific sources. Subsequently, intermediate tests and post-tests were conducted on the study sample.

10. Pre-tests

The pre-tests for the study sample were conducted on 15/2/2025 in the presence of all members of the research sample, as shown in Table (2).

Table(2). Shows the pre-test results

No.	Test	Unit of Measurement	Number	Mean	Standard Deviation	Skewness
1	Genu Varum (Bow Legs) Test	cm	3	1.5	0.74	0.17
2	30 m Sprint Test	second	3	5.2	1.52	0.21
3	Zigzag Running Test	second	3	1.3	0.67	0.00

This table illustrates the descriptive statistical values of the pre-tests conducted on the study sample prior to the implementation of the rehabilitation program.

11. Implementation of the Rehabilitation Program

After conducting the pre-test, the researcher proceeded to apply the rehabilitation program, which included rehabilitation exercises and assistive tools. The program was implemented in accordance with scientific and educational principles, while taking into consideration the proper integration of the rehabilitation exercises with the assistive tools used.[9]

- **Intermediate Test**

Before completing the implementation of the rehabilitation program, which included rehabilitation exercises and assistive tools, the researcher conducted the intermediate tests on the study sample on 15/2/2025. The researcher ensured that the same conditions and procedures applied in the pre-tests were maintained, in order to accurately identify the developments and changes that occurred in the study sample.

- **Post-tests**

After completing the implementation of the rehabilitation program, which included rehabilitation exercises and assistive tools, the researcher conducted the post-tests on the study sample on 15/5/2025. The researcher ensured that the same conditions and procedures followed in the pre-tests were applied.

Results and Discussion

This section presents the results reached by the current study and interprets them in light of the objectives set for the research, as follows:

Presentation and Analysis of Results for the Genu Varum (Bow Legs) Test

Table(3). Shows the mean, standard deviation, and calculated (F) value for the genu varum test in the pre-, intermediate, and post-tests.

Test Stage	Mean	Standard Deviation	Mean Squares Between Tests	Error of Variable	Calculated (F) Value	Sig.	Type of Difference
Pre-test	2.90	0.73	2.877	0.748	3.846	0.000	Significant
Intermediate test	2.10	1.17					
Post-test	1.70	0.56					

The table illustrates the meaning, standard deviation, and the calculated (F) value for the genu varum (bow legs) test across the pre-test, intermediate test, and post-test, indicating statistically significant differences among the three testing stages.[10]

Discussion and Analysis of Results for the Genu Varum (Bowlegs) Test

The results presented in Table (3) showed that the calculated (F) values for the experimental group across all studied variables were statistically significant, as the significance level (Sig.) was less than the adopted level of significance (0.05). This indicates the presence of a significant difference between the pre-test and the post-test for all variables.

It is also evident that the mean decreased with the progression of the rehabilitation period, approaching the normal alignment level of the lower limbs. This improvement confirms the effectiveness of the rehabilitation program in reducing the degree of genu varum and subsequently maintaining the achieved correction.[11]

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Presentation and Analysis of Results for the 30 m Sprint Test

Table(4). Shows the mean, standard deviation, and calculated (F) value for the 30 m sprint test in the pre-, intermediate, and post-tests.

Test Stage	Mean	Standard Deviation	Mean Squares Between Tests	Error of Variable	Calculated (F) Value	Sig.	Type of Difference
Pre-test	5.96	1.66	28.08	24.63	5.13	0.000	Significant
Intermediate test	5.57	1.76					
Post-test	4.63	1.52					

The table presents the mean, standard deviation, and the calculated (F) value for the 30 m sprint test across the pre-test, intermediate test, and post-test, indicating statistically significant differences among the three testing stages.

Discussion and Analysis of Results for the 30 m Sprint Test

Through the presentation and analysis of the results obtained from the pre- and post-tests, as shown in the above tables, statistically significant differences were observed between the tests, indicating a clear improvement in the speed variable in favor of the post-test.

The researcher attributes the improvement achieved by the experimental group in the post-test of the speed variable to the rehabilitation exercises included in the designed rehabilitation program. These exercises were specifically prepared to develop speed while taking into account the physical condition of the study sample, as well as ensuring variety and progression from simple to more difficult exercises.[12]

Presentation and Analysis of Results for the Zigzag Running Test

Table(5). Shows the mean, standard deviation, and calculated (F) value for the zigzag running test in the pre-, intermediate, and post-tests.

Test Stage	Mean	Standard Deviation	Mean Squares Between Tests	Error of Variable	Calculated (F) Value	Sig.	Type of Difference
Pre-test	2.40	1.13	17.08	10.7	7.18	0.000	Significant
Intermediate test	1.83	1.35					
Post-test	1.33	0.66					

The table illustrates the mean, standard deviation, and the calculated (F) value for the zigzag running test across the pre-test, intermediate test, and post-test, indicating statistically significant differences among the three testing stages.

Discussion and Analysis of Results for the Zigzag Running Test

Based on the presentation and analysis of the results obtained from the pre-, intermediate, and post-tests of the study sample, as shown in the table above, statistically significant differences were observed among the testing stages. This indicates a clear improvement in the agility variable in favor of the post-test.[13]

The researcher attributes the significance of these differences to the rehabilitation program, the assistive means, and the rehabilitation exercises applied. The training used within this approach positively influenced the development of agility during exercise performance and enhanced physical movement patterns through the integration of exercises according to the principles of correct performance. Moreover, the exercises included in the training program contributed to smoothness and efficiency of movement and improved performance capacity, as agility is a key component in most daily physical activities in general.[14]

Conclusions

1. The rehabilitation program and the assistive means used in the rehabilitation exercises prepared by the researcher demonstrated high effectiveness in developing the components of physical fitness.
2. The rehabilitation program significantly and positively reduced the distance between the heels compared to the pre-intervention condition.
3. The rehabilitation program positively increased the distance between the knees, which contributed to reducing the degree of genu varum among the affected pupils.
4. The rehabilitation program had a positive effect on developing and improving the physical and motor fitness of the pupils, bringing them close to a near-normal condition.
5. The use of rehabilitation exercises supported by assistive tools positively contributed to the improvement of the condition.
6. After completing the rehabilitation program, no negative effects on the condition were observed; on the contrary, positive indicators of improvement were achieved.

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7. The commitment of the sample participants to performing the rehabilitation program exercises and using the assistive tools helped in obtaining accurate and reliable results for the sample.
8. The number of rehabilitation sessions included in the prepared program was relatively sufficient to produce noticeable changes in the post-test results.

Recommendations

1. Using the rehabilitation program with assistive tools in the treatment of genu varum (bow legs).
2. Employing assistive tools in rehabilitation programs, as they are essential and cannot be separated from the program.
3. Adding more exercises suitable for different cases and conditions.
4. Conducting studies on larger samples than the current study sample.
5. Proposing the generalization of the program to medical clinics and relevant health institutions.
6. Conducting similar research in the field of rehabilitation of genu varum in its various forms.
7. Early detection of the causes of genu varum in children to prevent the progression of the condition in the future.
8. Emphasizing the practice of rehabilitation exercises to strengthen ligaments and muscles of the legs.
9. Encouraging pupils to participate in physical education classes.
10. Providing some devices and tools that support the application of exercises and games in physical education lessons at this stage to develop physical and motor fitness.
11. Using the rehabilitation program with assistive tools in the rehabilitation of injuries.
12. Paying attention to the preventive aspect of the guidance and exercises applied during the experiment.

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